

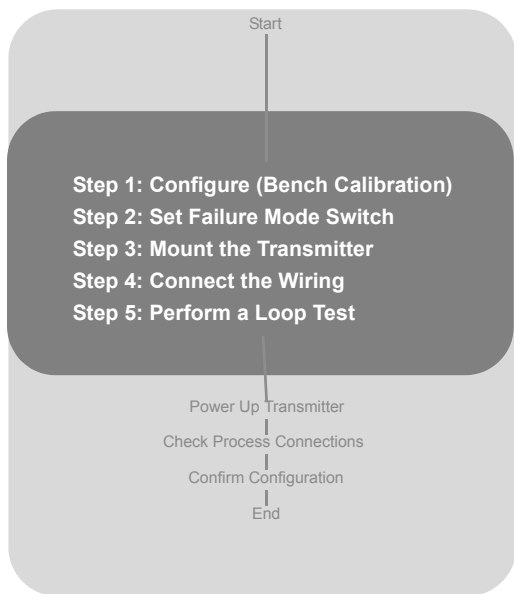
Quick Installation Guide

00825-0100-4728, Rev BA

May 2003

Rosemount 644

Rosemount 644H and 644R Smart Temperature Transmitters



HART® CE



ROSEMOUNT®

www.rosemount.com



EMERSON™
Process Management

Quick Installation Guide

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Rosemount 644

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IMPORTANT NOTICE

This installation guide provides basic guidelines for the Rosemount 644. It does not provide instructions for detailed configuration, diagnostics, maintenance, service, troubleshooting, or installation. Refer to the 644 Reference Manual (document number 00809-0100-4728) for more instruction. The manual and this QIG are also available electronically on www.rosemount.com.

WARNING

Explosions could result in death or serious injury:

Installation of this transmitter in an explosive environment must be in accordance with the appropriate local, national, and international standards, codes, and practices. Please review the Product Certifications for any restrictions associated with a safe installation. In an Explosion-Proof/Flame-Proof installation, do not remove the transmitter covers when power is applied to the unit.

Process leaks may cause harm or result in death

- Install and tighten thermowells or sensors before applying pressure.
- Do not remove the thermowell while in operation.

Electrical shock can result in death or serious injury

- Avoid contact with the leads and terminals. High voltage that may be present on leads can cause electrical shock.

STEP 1: CONFIGURE (BENCH CALIBRATION)

The 644 communicates using the HART Communicator (communication requires a loop resistance between 250 and 1100 ohms. Do not operate when power is below 12 Vdc at the transmitter terminal). Refer to the 644 Reference Manual (document number 00809-0100-4728) and the HART Communicator Reference Manual (document number 00809-0100-4275) for more information.

Update the HART Communicator Software

The HART Communicator Field Device Revision Dev v6, DD v1 or higher is required for complete functionality. The device will communicate with all previous 644 DD revisions.

Perform the following steps to determine if an upgrade is required.

1. Connect the sensor (see the wiring diagram located on the inside of the housing cover).
2. Connect the bench power supply to the power terminals (“+” or “-”).
3. Connect a HART Communicator to the loop across a loop resistor or at the power/signal terminals on the transmitter.
4. The following message will appear if the communicator has a previous version of the device descriptors (DDs).

NOTICE: Upgrade the communicator software to access new XMTR functions. Continue with old description?

NOTE:

If this notice does not appear, the latest DD is installed. If the latest version is not available, the communicator will communicate properly. But, when the transmitter is configured to utilize the advanced features of the transmitter (such as one of the added sensor input types), the user will experience trouble communicating and will be prompted to turn the communicator off. To prevent this from happening, upgrade to the latest DD or answer NO to the question and default to the generic transmitter functionality

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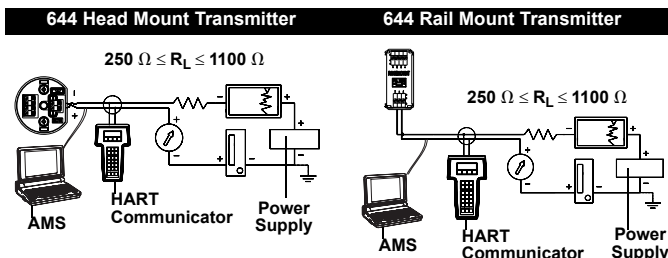
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STEP 1 CONTINUED...

Figure 1. Connecting a Communicator to a Bench Loop.



Verify Transmitter Configuration

From the Home Screen, enter the HART Fast Keys listed below to verify if the transmitter is configured correctly. This table contains the minimum functions required for configuration. Refer to the 644 Reference Manual (document number 00809-0100-4728) for a complete list.

Communicator Functions	HART Fast Keys
LRV (Lower Range Value)	1, 1, 6
Sensor 1 Setup	1, 3, 2, 1, 2
Sensor Type	1, 3, 2, 1, 1
URV (Upper Range Value)	1, 1, 7
Variable Mapping	1, 3, 1
Verify Callendar Van-Dusen Constants (f applicable)	1, 3, 2, 1, 3

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STEP 1 CONTINUED...

Input/Verify Callendar Van-Dusen Constants

If sensor matching is being used with this combination of a transmitter and sensor, verify the constants input.

1. At the **Home** screen, select *1 Device Setup, 3 Configuration, 2 Sensor Config, 1, 1 Sensor 1, 3 Cal Van-Dusen*. Set the control loop to manual. Select **OK**
2. Select *Cal Van-Dusen* at the **Enter Sensor Type** prompt.
3. Select the appropriate number of wires at the **Enter Sensor Connection** prompt.
4. Enter the R_0 , Alpha, Beta, and Delta values from the stainless steel tag attached to the special-order sensor.
5. Select **OK** after you return the control loop to automatic control.

STEP 2: SET FAILURE MODE SWITCH

644H (switch on bottom right of electronics module)

Without a LCD Display

1. Set the loop to manual (if applicable) and disconnect the power.
2. Remove the electronics housing cover.
3. Set the switch to the desired position. Reattach housing cover.
4. Apply power and set the loop to automatic control.

With a LCD Display (644H only)

1. Set the loop to manual (if applicable) and disconnect the power.
2. Remove the electronics housing cover.
3. Snap-off the LCD display straight off.
4. Set the switch to the desired position.
5. Reattach the LCD display and electronics housing cover (consider LCD display orientation – rotate in 90 degree increments).
6. Apply power and set the loop to automatic control.

644R (switch on middle of front panel)

1. Open the front door of the 644R Rail Mount Transmitter
2. Set the switch to the desired position.

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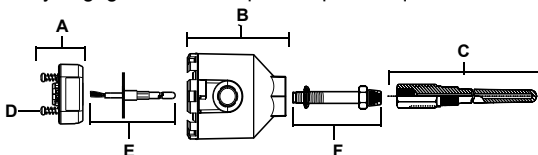
STEP 3: MOUNT THE TRANSMITTER

Mount the transmitter at a high point in the conduit run to prevent moisture from draining into the transmitter housing.

Typical Connection Head Installation

Head Mount Transmitter with DIN Plate Style Sensor

1. Attach the thermowell to the pipe or process container wall. Install and tighten the thermowell before applying process pressure.
2. Verify the transmitter failure mode switch.
3. Assemble the transmitter to the sensor. Push the transmitter mounting screws through the sensor mounting plate and insert the snap rings (optional) into the transmitter mounting screw groove.
4. Wire the sensor to the transmitter (see Step 4: Connect the Wiring).
5. Insert the transmitter-sensor assembly into the connection head. Thread the transmitter mounting screw into the connection head mounting holes. Assemble the extension to the connection head. Insert the assembly into the thermowell.
6. Slip the shielded cable through the cable gland.
7. Attach a cable gland into the shielded cable.
8. Insert the shielded cable leads into the connection head through the cable entry. Connect and tighten the cable gland.
9. Connect the shielded power cable leads to the transmitter power terminals. Avoid contact with sensor leads and sensor connections.
10. Install and tighten the connection head cover. Enclosure covers must be fully engaged to meet explosion-proof requirements.



A = 644H Transmitter

B = Connection Head

C = Thermowell

D = Transmitter Mounting Screws

E = Integral Mount Sensor with Flying Leads

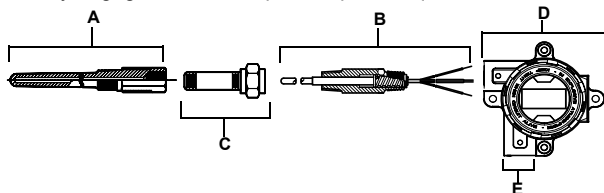
F = Extension

STEP 3 CONTINUED...

Typical Universal Head Installation

Head Mount Transmitter with Threaded Sensor

1. Attach the thermowell to the pipe or process container wall. Install and tighten thermowells before applying process pressure.
2. Attach necessary extension nipples and adapters to the thermowell. Seal the nipple and adapter threads with silicone tape.
3. Screw the sensor into the thermowell. Install drain seals if required for severe environments or to satisfy code requirements.
4. Verify the transmitter failure mode switch.
5. Pull the sensor wiring leads through the universal head and transmitter. Mount the transmitter in the universal head by threading the transmitter mounting screws into the universal head mounting holes.
6. Mount the transmitter-sensor assembly into the thermowell. Seal adapter threads with silicone tape.
7. Install conduit for field wiring to the conduit entry of the universal head. Seal conduit threads with silicone tape.
8. Pull the field wiring leads through the conduit into the universal head. Attach the sensor and power leads to the transmitter. Avoid contact with other terminals.
9. Install and tighten the universal head cover. Enclosure covers must be fully engaged to meet explosion-proof requirements.



A = Threaded Thermowell
B = Threaded Style Sensor
C = Standard Extension

D = Universal Head (transmitter inside)
E = Conduit Entry

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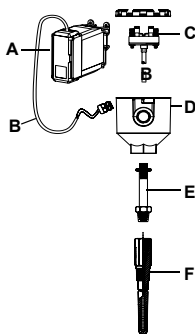
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STEP 3 CONTINUED...

Rail Mount Transmitter and Sensor

1. Attach the transmitter to a suitable rail or panel.
2. Attach the thermowell to the pipe or process container wall. Install and tighten the thermowell, according to plant standards, before applying pressure.
3. Attach the sensor to the connection head and mount the entire assembly to the thermowell.
4. Attach and connect sufficient lengths of sensor lead wire from the connection head to the sensor terminal block.
5. Tighten the connection head cover. Enclosure covers must be fully engaged to meet explosion-proof requirements.
6. Run sensor lead wires from the sensor assembly to the transmitter.
7. Verify the transmitter failure mode switch.
8. Attach the sensor wires to the transmitter (see Step 4: Connect the Wiring for more information).



A = Rail Mount Transmitter

B = Sensor Leads with Cable Glands

C = Integral Mount Sensor with Terminal Block

D = Connection Head

E = Standard Extension

F = Threaded Thermowell

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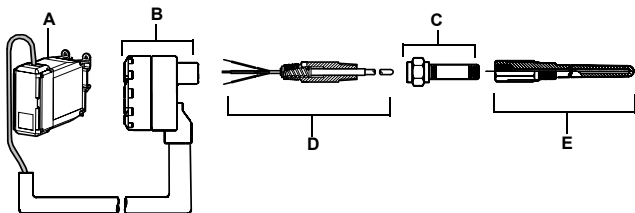
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STEP 3 CONTINUED...

Rail Mount Transmitter with Threaded Sensor

1. Attach the transmitter to a suitable rail or panel.
2. Attach the thermowell to the pipe or process container wall. Install and tighten the thermowell before applying pressure.
3. Attach necessary extension nipples and adapters. Seal the nipple and adapter threads with silicone tape.
4. Screw the sensor into the thermowell. Install drain seals if required for severe environments or to satisfy code requirements.
5. Screw the connection head to the sensor.
6. Attach the sensor lead wires to the connection head terminals.
7. Attach additional sensor lead wires from the connection head to the transmitter.
8. Attach and tighten the connection head cover. Enclosure covers must be fully engaged to meet explosion-proof requirements.
9. Set the transmitter failure mode switch
10. Attach the sensor wires to the transmitter (see Step 4: Connect the Wiring for more information).



A = Rail Mount Transmitter

C = Standard Extension

B = Threaded Sensor Connection Head D = Threaded Style Sensor

E = Threaded Thermowell

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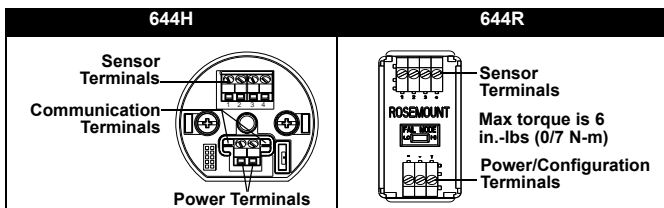
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STEP 4: CONNECT THE WIRING

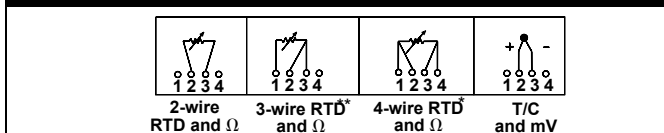
- Wiring diagrams are located inside the terminal block cover.
- An external power supply is required to operate the transmitter.
- The power required across the transmitter power terminals is 12 to 42.4 VDC (the power terminals are rated to 42.4 VDC). To prevent damaging the transmitter, do not allow terminal voltage to drop below 12.0 VDC when changing the configuration parameters.

Power the Transmitter

1. Remove the terminal block cover (if applicable).
2. Connect the positive power lead to the “+” terminal. Connect the negative power lead to the “-” terminal.
3. Tighten the terminal screws. When tightening the sensor and power wires, the max torque is 6 in.-lbs (0.7 N-m).
4. Reattach and tighten the cover (if applicable).
5. Apply power (12 – 42 VDC).



Sensor Connections Diagram



* The transmitters must be configured for at least a 3-wire RTD in order to recognize an RTD with a compensation loop.

** Rosemount Inc. provides 4-wire sensors for all single element RTDs. Use these RTDs in 3-wire configurations by leaving the unneeded leads disconnected and insulated with electrical tape.

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STEP 4 CONTINUED...

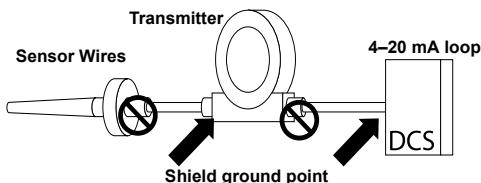
Ground the Transmitter

Ungrounded Thermocouple, mV, and RTD/Ohm Inputs

Each process installation has different requirements for grounding. Use the grounding options recommended by the facility for the specific sensor type, or begin with grounding Option 1 (the most common).

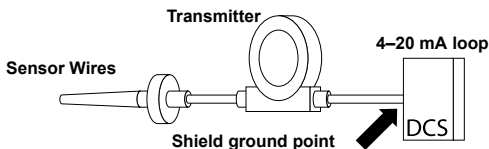
Option 1:

1. Connect sensor wiring shield to the transmitter housing.
2. Ensure the sensor shield is electrically isolated from surrounding fixtures that may be grounded.
3. Ground signal wiring shield at the power supply end.



Option 2:

1. Connect signal wiring shield to the sensor wiring shield.
2. Ensure the two shields are tied together and electrically isolated from the transmitter housing.
3. Ground shield at the power supply end only.
4. Ensure that the sensor shield is electrically isolated from the surrounding grounded fixtures.



Connect shields together, electrically isolated from the transmitter

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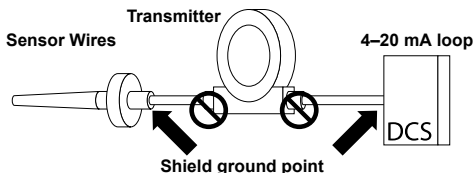
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STEP 3 CONTINUED...

Option 3:

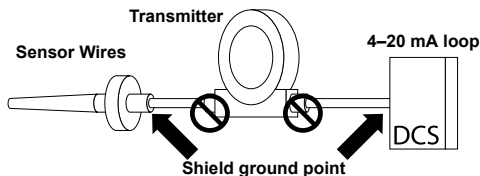
1. Ground sensor wiring shield at the sensor, if possible.
2. Insure that the sensor wiring and signal wiring shields are electrically isolated from the transmitter housing.
3. Do not connect the signal wiring shield to the sensor wiring shield.
4. Ground signal wiring shield at the power supply end.



Grounded Thermocouple Inputs

Option 4

1. Ground sensor wiring shield at the sensor.
2. Ensure that the sensor wiring and signal wiring shields are electrically isolated from the transmitter housing.
3. Do not connect the signal wiring shield to the sensor wiring shield.
4. Ground signal wiring shield at the power supply end.



STEP 5: PERFORM A LOOP TEST

The Loop Test command verifies transmitter output, loop integrity, and operation of any recorders or similar devices installed in the loop.

Initiate a loop test:

1. Connect an external ampere meter in series with the transmitter loop (so the power to the transmitter goes through the meter at some point in the loop).
2. From the home screen select:
644H and 644R:
1 Device Setup, 2 Diag/Serv, 1 Test Device, 1 Loop Test.
3. Select a discreet milliampere level for the transmitter to output. At **Choose Analog Output** select *1 4mA*, *2 20mA* or select *3 Other* to manually input a value between 4 and 20 milliamperes. Select **Enter** to show the fixed output. Select **OK**.
4. In the test loop, check the transmitter's actual mA output and the HART mA reading are the same value. If the readings do not match, either the transmitter requires an output trim or the current meter is malfunctioning.
5. After completing the test, the display returns to the loop test screen and allows the user to choose another output value. To end the Loop Test, Select *5 End* and **Enter**.

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PRODUCT CERTIFICATIONS

Approved Manufacturing Locations

Emerson Process Management Rosemount Division. – Chanhassen, Minnesota, USA

Rosemount Temperature GmbH – Germany

Emerson Process Management Asia Pacific – Singapore

European Union Directive Information

The EC declaration of conformity for all applicable European directives for this product can be found on the Rosemount website at www.rosemount.com. A hard copy may be obtained by contacting our local sales representative.

ATEX Directive (94/9/EC)

Rosemount Inc. complies with the ATEX Directive.

Electro Magnetic Compatibility (EMC) (89/336/EEC)

644H and 644R – EN 50081-1: 1992; EN 50082-2:1995;
EN 61326-1:1997 +A1

NAMUR NE 21 Recommendations

The 644H HART meets the NAMUR NE 21 Rating requirements

Susceptibility	Parameter	Influence
ESD	<ul style="list-style-type: none">• 6 kV contact discharge• 8 kV air discharge	None
Radiated	<ul style="list-style-type: none">• 80 – 1000 MHz at 10 V/m AM	< 0.5%
Burst	<ul style="list-style-type: none">• 1 kV for I.O.	None
Surge	<ul style="list-style-type: none">• 0.5 kV line–line• 1 kV line–ground (I.O. tool)	None
Conducted	<ul style="list-style-type: none">• 150 kHz to 80 MHz at 10 V	< 0.5%

CE Mark

The 644H and 644R meet all requirements listed under IEC 61326:Amendment 1, 1998

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Hazardous Locations Certificates

North American Certifications

Factory Mutual (FM) Approvals

I5 FM Intrinsic Safety and Non-incendive:

Intrinsically Safe for Class I/II/III, Division 1, Groups A, B, C, D, E, F, and G.

Non-incendive for Class I, Division 2, Groups A, B, C, and D.

Intrinsically Safe and non-incendive when installed in accordance with Rosemount drawing 00644-0009.

Table 1. Temperature Code

Pi	Temperature Code
0.67 W	T5 ($T_{amb} = -50^{\circ}\text{C}$ to 50°C)
0.67 W	T6 ($T_{amb} = -50^{\circ}\text{C}$ to 40°C)
1.0 W	T4 ($T_{amb} = -50^{\circ}\text{C}$ to 80°C)
1.0 W	T5 ($T_{amb} = -50^{\circ}\text{C}$ to 40°C)

E5 FM Explosion-Proof and Non-incendive:

Explosion-Proof for Class I, Division 1, Groups B, C, and D. Dust

Ignition Proof for Class II/III, Division 1, Groups E, F, G when

installed per Rosemount Drawing 00644-1049. Non-incendive for Class 1, Division 2, Groups A, B, C, and D. Temperature Code: T5 ($T_{amb} = -50^{\circ}\text{C}$ to 85°C)

Conduit seal not required for compliance with NEC501-5a(1).

Note

Approval E5 is only available with 644H option codes J5 and J6.

K5 Combination of I5 and E5.

Note

K5 is only available with 644H option code J6.

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Canadian Standards Association (CSA) Approvals

I6 CSA Intrinsic Safety

Intrinsically Safe for Class I, Division 1, Groups A, B, C, and D when installed in accordance with Rosemount drawing 00644–1064.

Table 2. Temperature Code

Pi	Temperature Code
0.67 W	T6 ($T_{amb} = -50\text{ }^{\circ}\text{C}$ to $40\text{ }^{\circ}\text{C}$)
0.67 W	T5 ($T_{amb} = -50\text{ }^{\circ}\text{C}$ to $60\text{ }^{\circ}\text{C}$)
1.0 W	T4 ($T_{amb} = -50\text{ }^{\circ}\text{C}$ to $80\text{ }^{\circ}\text{C}$)

K6 CSA Intrinsic Safety, Explosion–Proof, and Non-incendive.

Combination of I6 and Explosion–proof for Class I, Division 1, Groups B, C, and D; Dust-ignition proof for Class II, Division 1, Groups E, F, and G; Class III, Division 1 hazardous locations, when installed in accordance with Rosemount drawing 00644–1059.

Suitable for Class I, Division 2, Groups B, C, and D when installed in a suitable enclosure.

Temperature Code: Ambient Limits -50°C to 85°C .

Note

K6 is only available with 644H option code J6.

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European Certifications

CENELEC ATEX Approvals

I1 CENELEC Intrinsic Safety:

Certificate Number: BAS00ATEX1033X

ATEX Marking:  II 1 G EEx ia IIC T4/T5/T6

CE 1180

Table 3. Temperature Code

Pi	Temperature Code
0.67 W	T6 ($T_{amb} = -60\text{ }^{\circ}\text{C}$ to $40\text{ }^{\circ}\text{C}$)
0.67 W	T5 ($T_{amb} = -60\text{ }^{\circ}\text{C}$ to $50\text{ }^{\circ}\text{C}$)
1.0 W	T5 ($T_{amb} = -60\text{ }^{\circ}\text{C}$ to $40\text{ }^{\circ}\text{C}$)
1.0 W	T4 ($T_{amb} = -60\text{ }^{\circ}\text{C}$ to $80\text{ }^{\circ}\text{C}$)

Table 4. Entity Parameters

Loop/Power	Sensor
$U_i = 30\text{ V}$	$U_o = 13.6\text{ V}$
$I_i = 200\text{ mA}$	$I_o = 80\text{ mA}$
$P_i = 0.67\text{ W}$ or 1.0 W	$P_o = 80\text{ mW}$
$C_i = 10\text{ nF}$	$C_i = 75\text{ nF}$
$L_i = 0$	$L_i = 0$


Special Conditions for Safe Use (X):

The transmitter must be installed so that its external terminals and communication pins are protected to at least IP20.

Non-metallic enclosures must have a surface resistance of less than $1\text{ G}\Omega$. Light alloy or zirconium enclosures must be protected from impact and friction when installed.

E1 CENELEC Flame-Proof:

Certificate Number: KEMA99ATEX8715

ATEX Marking:  II 2 G EEx d IIC T6

CE 1180

Temperature Code: T6 ($T_{amb} = -40\text{ }^{\circ}\text{C}$ to $65\text{ }^{\circ}\text{C}$)

Max Input Voltage: $U_i = 55\text{ Vdc}$

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N1 CENELEC Type n:

Certificate Number: BAS00ATEX3145

ATEX Marking:  II 3 G EEx nL IIC T5

Temperature Code: T5 ($T_{amb} = -40^{\circ}\text{C}$ to 70°C)

Max Input Voltage: $U_i = 45\text{Vdc}$

NC CENELEC Type n Component:

Certificate Number: BAS99ATEX3084U

ATEX Marking:  II 3 G EEx nL IIC T5

Temperature Code: T5 ($T_{amb} = -40^{\circ}\text{C}$ to 70°C)

Max Input Voltage: $U_i = 45\text{Vdc}$

Note

The equipment must be installed in an enclosure meeting the requirements of IP54 and the requirements of the impact tests described in EN50021.

Australian Certifications

Standard Australia Quality Assurance Service (SAA) Approvals

Note

Consult factory for SAA availability.

E7 SAA Explosion-Proof

Certificate Number: AUS Ex3706X

Ex d IIC T6

Temperature Code: T6 ($T_{amb} = -40^{\circ}\text{C}$ to 65°C)

Note

Flame-Proof certification is only available as a complete assembly with Rosemount universal head – option codes J5 or J6.

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I7 SAA Intrinsic Safety

Certificate Number: AUS Ex 03.3877X

Ex ia IIC

Temperature Code: T5 ($T_{amb} = -60$ to $75\text{ }^{\circ}\text{C}$)

T6 ($T_{amb} = -60$ to $50\text{ }^{\circ}\text{C}$)

Table 5. Input Entity Parameters

Loop / Power	Sensor
$U_i = 30\text{ V dc}$	$U_o = 17.3\text{ V}$
$I_i = 200\text{ mA}$	$I_o = 247\text{ mA}$
$P_i = 1.0\text{ W}$	$P_o = 0.08\text{ W}$
$C_i = 5.3\text{ nF}$	$C_o = 0.70\text{ }\mu\text{F}$
$L_i = 0\text{ mH}$	$L_o = 3.13\text{ mH}$

Special Condition for Safe Use (X):

1. It is a condition of safe use that for Ex ia applications, the equipment is to be housed in an enclosure that provides an ingress protection rating of not less than IP20.
2. It is a condition of safe use that the installation shall be carried out in according with Rosemount drawing 00644-1044.
3. It is a condition of safe use that a user may fit an optional LCD indicator to 644H Temperature Transmitter certified in this certificate after installation subject to the conditions requirement of this certificate.

N7 SAA Type n

Certificate Number: AUS Ex 03.3877X

Ex n IIC

Temperature Code: T5 ($T_{amb} = -60$ to $75\text{ }^{\circ}\text{C}$)

T6 ($T_{amb} = -60$ to $50\text{ }^{\circ}\text{C}$)

Special Condition for Safe Use (X):

1. It is a condition of safe use that for Ex n applications, the equipment is to be housed in an enclosure that provides an ingress protection rating of not less than IP54.
2. Input parameters for non-sparking protection model: Ex n
Input Parameters Power/Loop Terminals (Pins "+", "-", "T"):
Maximum Input Voltage $U_n = 55\text{ V}$
Maximum Input Power $P_n = 1.3\text{ W}$

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Brazilian Certifications

Centro de Pesquisas de Energia Eletrica (CEPEL) Approval

I2 CEPEL Intrinsic Safety. Not available, consult factory

Japanese Certifications

Japanese Industrial Standard (JIS) Approvals

E4 JIS Explosion-Proof

Table 6. Certificate and Description

Certificate	Description	Approval Group	Temp Code
C15744	644H with meter and no sensor	Ex d II C	T6
C15745	644H without meter and no sensor	Ex d II C	T6
C15749	644H without meter and with RTD	Ex d II B	T4
C15750	644H without meter and with thermocouple	Ex d II B	T4
C15751	644H with meter and with thermocouple	Ex d II B	T4
C15752	644H with meter and with RTD	Ex d II B	T4
C15910	644H without meter and with thermocouple	Ex d II B + H2	T4
C15911	644H with meter and with thermocouple	Ex d II B + H2	T4
C15912	644H without meter and with RTD	Ex d II B + H2	T4
C15913	644H with meter and with RTD	Ex d II B + H2	T4

Russian Certifications

Gostandart

Tested and approved by the Russian Metrological Institute
GOSTANDART.